7457

Beam Power Tube

CERAMIC-METAL SEALS — **COAXIAL-ELECTRODE STRUCTURE**
"ONE-PIECE" ELECTRODE DESIGN — **INTEGRAL RADIATOR**
FORCED-AIR COOLED — **180 WATTS CW INPUT UP TO 1215 Mc/s**
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use at Frequencies up to 2000 Mc/s under Severe Shock and Vibration

ELECTRICAL

Heater

For Matrix-Type, Oxide-Coated, Unipotential Cathode:

Voltage (AC or DC)[a]	6.3 ± 10%	V
Current at heater volts = 6.3	3.2	A
Minimum heating time	60	s
Mu-Factor (Grid No.2 to Grid No.1)	18	

Plate volts = 250, grid-No.2 volts = 250, and plate mA = 100 .

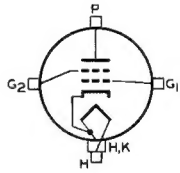
Direct Interelectrode Capacitances[b]

Grid No.1 to plate	0.065 max	pF
Grid No.1 to cathode & heater	14	pF
Plate to cathode & heater	0.019 max	pF
Grid No.1 to grid No.2	19	pF
Grid No.2 to plate	4.5	pF
Grid No.2 to cathode & heater	1.3 max	pF

MECHANICAL

Operating Position . . . . . **Any**
Maximum Overall Length . . . . . **1.930 in** ←
Maximum Diameter (See *Dimensional Outline*) . . . . . **1.265 in**
Weight (Approx.) . . . . . **2 oz**
Radiator . . . . . **Integral part of tube**
Socket
For frequencies up to about 400 Mc/s. . . . . **Footnote c**
For use at higher frequencies . . . **See** *Mounting Arrangement*
Terminal Connections (See *Dimensional Outline*)

G_1 – Grid-No.1– Terminal Contact Surface
G_2 – Grid-No.2– Terminal Contact Surface
H – Heater– Terminal Contact Surface
H,K – Heater– & Cathode– Terminal Contact Surface
P – Plate– Terminal Contact Surface



THERMAL

Plate, Grid No.2, Grid No.1, Cathode, and Heater Temperature	250 max	°C
Radiator-Core Temperature	250 max	°C

← Indicates a change.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices — Harrison, N. J.
DATA I
9-65

Air Flow[x]

Through radiator — Adequate air flow to limit the radiator-core temperature to 250°C should be delivered by a blower across the radiator before and during the application of plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed across the radiator versus plate dissipation are shown in accompanying *Typical-Cooling-Requirements* curves.

To Plate, grid-No.2, grid-No.1, cathode, and heater terminals — A sufficient quantity of air should flow across each of these terminals so that their temperature does not exceed the specified maximum value of 250°C.

During Standby Operation — Cooling air is not normally required when only heater voltage is applied to the tube. Plate power, grid-No.2 power, heater power, and air flow may be removed simultaneously.

At Sea Level — Cooling requirements with air flow directed across the radiator with cowling may be met by use of the following blowers and associated motors manufactured by Rotron Mfg. Co., Inc., Woodstock, N.Y., or equivalent:

For 100% Plate Dissipation:				
Blower Model No.	KS-2505	AS-2505	AXIMAX I	AXIMAX I
Motor Model No.	165AS	323JS	464YS	499JS
Phase (φ)	1	3	1	3
Frequency (c/s)	60	60	400	400
Voltage (V)	115	220	115	200
For 80% Plate Dissipation:				
Blower Model No.	KS-202	AS-202	AXIMAX I	AXIMAX I
Motor Model No.	92AS	323JS	464YS	499JS
Phase (φ)	1	3	1	3
Frequency (c/s)	60	60	400	400
Voltage (V)	115	220	115	200
For 60% Plate Dissipation:				
Blower Model No.	KS-1504	AS-1504	AXIMAX I	AXIMAX I
Motor Model No.	92AS	323JS	464YS	499JS
Phase (φ)	1	3	1	3
Frequency (c/s)	60	60	400	400
Voltage (V)	115	220	115	200

AF POWER AMPLIFIER & MODULATOR — CLASS AB_1[d,y]

Maximum CCS[e] Ratings, Absolute-Maximum Values

DC Plate Voltage	**1000**	**V**
DC Grid-No.2 (Screen-Grid) Voltage	**300**	**V**
Max.-Signal DC Plate Current[f]	**180**	**mA**
Max.-Signal Plate Input[f]	**180**	**W**
Max.-Signal Grid-No.2 Input[f]	**4.5**	**W**
Plate Dissipation[f]	**115**	**W**

Typical CCS Operation

Values are for 2 tubes

DC Plate Voltage	**650**	**850**	**V**
DC Grid-No.2 Voltage[g]	**300**	**300**	**V**
DC Grid-No.1 (Control-grid) Voltage. From fixed-bias source	**-15**	**-15**	**V**
Peak AF Grid-No.1-to-Grid-No.1 Voltage[h]	**30**	**30**	**V**

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Zero-Signal DC Plate Current	80	80	mA
Max.-Signal DC Plate Current	200	200	mA
Zero-Signal DC Grid-No.2 Current	0	0	mA
Max.-Signal DC Grid-No.2 Current	20	20	mA
Effective Load Resistance (Plate to plate)	4330	7000	Ω
Max.-Signal Driving Power (Approx.)	0	0	W
Max.-Signal Power Output (Approx.)	50	80	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance
Under any condition:[j]
For fixed-bias operation . . . . . 30000 Ω
For cathode-bias operation . . . . . Not recommended

AF POWER AMPLIFIER & MODULATOR — CLASS AB_2[k,y]

Maximum CCS[e] Ratings, Absolute-Maximum Values

DC Plate Voltage	1000	V
DC Grid-No.2 (Screen-Grid) Voltage	300	V
Max.-Signal DC Plate Current[f]	180	mA
Max.-Signal DC Grid-No.1 (Control-Grid) Current[f]	30	mA
Max.-Signal Plate Input[f]	180	W
Max.-Signal Grid-No.2 Input[f]	4.5	W
Plate Dissipation[f]	115	W

Typical CCS Operation

Values are for 2 tubes

DC Plate Voltage	650	850	V
DC Grid-No.2 Voltage[q]	300	300	V
DC Grid-No.1 Voltage (From fixed-bias source)	-15	-15	V
Peak AF Grid-No.1-to-Grid-No.1 Voltage	46	46	V
Zero-Signal DC Plate Current	80	80	mA
Max.-Signal DC Plate Current	355	355	mA
Zero-Signal DC Grid-No.2 Current	0	0	mA
Max.-Signal DC Grid-No.2 Current	25	25	mA
Max.-Signal DC Grid-No.1 Current	15	15	mA
Effective Load Resistance (Plate to plate)	2450	3960	Ω
Max.-Signal Driving Power (Approx.)[m]	0.3	0.3	W
Max.-Signal Power Output (Approx.)	85	140	W

LINEAR RF POWER AMPLIFIER — CLASS AB_1[y]

SINGLE-SIDEBAND SUPPRESSED-CARRIER SERVICE

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2

Maximum CCS[e] Ratings, Absolute-Maximum Values

	Up to 1215 Mc/s	
DC Plate Voltage	1000	V
DC Grid-No.2 (Screen-Grid) Voltage	300	V
Max.-Signal DC Plate Current	-100	mA
DC Plate Current at Peak of Envelope	250[n]	mA

	Up to 1215 Mc/s	
Max.-Signal DC Grid-No.1 (Control-Grid) Current	30	mA
Max.-Signal Plate Input	180	W
Max.-Signal Grid-No.2 Input	4.5	W
Plate Dissipation	115	W

Typical CCS Class AB_1 "Single-Tone" Operation[p]

	Up to 60 Mc/s		
DC Plate Voltage	650	850	V
DC Grid-No.2 Voltage[g]	300	300	V
DC Grid-No.1 Voltage	-15	-15	V
Zero-Signal DC Plate Current	40	40	mA
Zero-Signal DC Grid-No.2 Current	0	0	mA
Effective RF Load Resistance	2165	3500	Ω
Max.-Signal DC Plate Current	100	100	mA
Max.-Signal DC Grid-No.2 Current	10	10	mA
Max.-Signal DC Grid-No.1 Current	0	0	mA
Max.-Signal Peak RF Grid-No.1 Voltage	15	15	V
Max.-Signal Driving Power (Approx.)	0	0	W
Max.-Signal Power Output (Approx.)	25	40	W

Typical CCS Operation with "Two-Tone" Modulation

	At 30 Mc/s		
DC Plate Voltage	650	850	V
DC Grid-No.2 Voltage	300	300	V
DC Grid-No.1 Voltage	-18.5	-18.5	V
Zero-Signal DC Plate Current	40	40	mA
Effective RF Load Resistance	2200	3500	Ω
DC Plate Current at Peak of Envelope	100	100	mA
Average DC Plate Current	75	75	mA
DC Grid-No.2 Current at Peak of Envelope	8.2	4.2	mA
Average DC Grid-No.2 Current	3.6	1.7	mA
Peak-Envelope Driver Power Output (Approx.)	0.5	0.5	W
Output-Circuit Efficiency (Approx.)	90	90	%
Distortion Products Level			
Third Order	35	30	dB
Fifth Order	40	36	dB
Useful Power Output (Approx.)			
Average	12.5	20	W
Peak envelope	25	40	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance (Under any condition)		
For fixed bias	25000	Ω
For fixed-bias operation (Class AB_1)	100000	Ω
For cathode-bias operation	Not recommended	

PLATE-MODULATED RF POWER AMPLIFIER — CLASS C TELEPHONY[y]

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS[e] Ratings, Absolute-Maximum Values

	Up to 1215 Mc/s	
DC Plate Voltage	800	V
DC Grid-No.2 (Screen-Grid) Voltage	300	V

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

	Up to 1215 Mc/s	
DC Grid-No.1 (Control-Grid) Voltage	-100	V
DC Plate Current	150	mA
DC Grid-No.1 Current	30	mA
Plate Input	120	W
Grid-No.2 Input[z]	3	W
Plate Dissipation	75	W

Typical CCS Operation

	At 400 Mc/s		
DC Plate Voltage	400	700	V
DC Grid-No.2 Voltage[q]	200	250	V
DC Grid-No.1 Voltage[r]	-20	-50	V
DC Plate Current	100	130	mA
DC Grid-No.2 Current	5	10	mA
DC Grid-No.1 Current	5	10	mA
Driver Power Output (Approx.)[s]	2	3	W
Useful Power Output (Approx.)	16	45	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance Under any condition	30000[t]	Ω

RF POWER AMPLIFIER & OSCILLATOR — CLASS C TELEGRAPHY[u,y]
and
RF POWER AMPLIFIER — CLASS C FM TELEPHONY[y]

Maximum CCS[e] Ratings, Absolute-Maximum Values

	Up to 1215 Mc/s	
DC Plate Voltage	1000	V
DC Grid-No.2 (Screen-Grid) Voltage	300	V
DC Grid-No.1 (Control-Grid) Voltage	-100	V
DC Plate Current	180	mA
DC Grid-No.1 Current	30	mA
Plate Input	180	W
Grid-No.2 Input	4.5	W
Plate Dissipation	115	W

Typical CCS Operation

	At 400 Mc/s		At 1215 Mc/s	
DC Plate Voltage	400	900	900	V
DC Grid-No.2 Voltage[v]	200	300	300	V
DC Grid-No.1 Voltage[w]	-35	-30	-22	V
DC Plate Current	150	170	170	mA
DC Grid-No.2 Current	5	1	1	mA
DC Grid-No.1 Current	3	10	4	mA
Driver Power Output (Approx.)[s]	3	3	5	W
Useful Power Output (Approx.)	23	80	40	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance Under any condition	30000[r]	Ω

[a] Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

[b] Measured with special shield adapter.

[c] For socket to be used with the 7457, consult manufacturers such as J-V-M Microwave Company, 9300 West 47th Street, Brookfield, Illinois; E.F. Johnson Company, Waseca, Minnesota; and Collins Radio Company, 855 35th Street North, Cedar Rapids, Iowa.

[d] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[e] Continuous Commercial Service.

[f] Averaged over any audio-frequency cycle of sine-wave form.

[g] Preferably obtained from a fixed supply.

[h] The driver stage should be capable of supplying the No.1 grids of the Class AB_1 stage with the specified driving voltage at low distortion.

[j] The resistance introduced into the grid-No.1 circuit by the input coupling should be held to a low value. In no case should it exceed the specified maximum value. Transformer or impedance coupling devices are recommended.

[k] Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

[m] Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held to a low value. For this purpose, the use of transformer coupling is recommended.

[n] The maximum rating for a signal having a minimum peak-to-average power ratio less than 2, such as is obtained in "Single-Tone" operation, is 180 mA. During short periods of Circuit Adjustment under "Single-Tone" conditions, the average plate current may be as high as 250 mA.

[p] "Single-Tone" operation refers to that class of amplifier service in which the grid-No.1 input consists of a monofrequency rf signal having constant amplitude. This signal is produced in a single-sideband suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.

[q] Obtained preferably from a separate source modulated along with the plate supply.

[r] Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

[s] The driver stage is required to supply tube losses and rf-circuit losses. It should be designed to provide an excess of power above the indicated values to take care of variations in line voltage, components, initial tube characteristics and tube characteristics during life.

[t] If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

[u] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

[v] Obtained preferably from a fixed supply, or from the plate supply voltage with a voltage divider.

[w] Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

[x] See *Cooling Considerations*—Forced-Air Cooling.

[y] See *Classes of Service*.

[z] See *Electrical Considerations*-Grid-No.2 Voltage Supply.

CHARACTERISTICS RANGE VALUES

Item No.		*Note*	*Min*	*Max*	
1.	**Heater Current**	1	2.90	3.55	A
2.	**Direct Interelectrode Capacitances**				
	Grid No.1 to plate	2	-	0.065	pF
	Grid No.1 to cathode & heater	2	11.8	15.2	pF
	Plate to cathode & heater.	2	-	0.019	pF
	Grid No.1 to grid No.2	2	17.3	21.9	pF

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Item No.		Note	Min	Max	
	Grid No.2 to plate.	2	4	5.1	pF
	Grid No.2 cathode & heater . .	2	-	1.30	pF
3.	Grid-No.1 Voltage.	1,3	-6	-18	V
4.	Reverse Grid-No.1 Current. . . .	1,3	-	-20	μA
5.	Grid-No.2 Current.	1,3	-8	+2	mA
6.	Peak Emission.	1,4	-	400	peak V
7.	Intere lectrode Leakage Resistance. .	5	1	-	MΩ
8.	Useful Power Output.	6	80	-	W

Note 1: With 6.3 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc plate volts = 1000, dc grid-No.2 volts = 300, and dc grid-No.1 voltage adjusted to give a dc plate current of 115 mA.

Note 4: For conditions with heater volts = 6.3; grid No.1, grid No.2, and plate tied together; and pulse-voltage source connected between plate and cathode. Pulse duration (microseconds) = 2, pulse-repetition frequency (pps) = 60, and duty factor of 0.00012. The voltage-pulse amplitude is adjusted until a peak cathode current of 10 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed 400 volts (peak).

Note 5: Under conditions with tube at 20° to 30°C for at least 30 minutes without any voltages applies to the tube. The minimum resistance between any two adjacent electrodes as measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1 megohm, will be 1 megohm.

→ **Note 6:** In a single-tube, grid-driven coaxial-cavity class-C amplifier circuit at 400 Mc/s for conditions with 5.7 volts ac or dc on heater, dc plate volts = 1000, dc grid-No.2 volts = 300, dc plate mA = 180 maximum, dc grid-No.1 mA = 30 maximum, and driver power output (watts) = 3.

SPECIAL TESTS & PERFORMANCE DATA

Resonances in the tube mountings used in the following tests can cause the specified environmental conditions to produce greatly amplified effects. Extreme care must, therefore, be used in the design of the mountings to minimize resonances. Design details of mountings used by the RCA Electronic Components and Devices to perform these tests may be obtained from RCA Commercial Engineering, Harrison, New Jersey, on request.

50 g, 11-Millisecond Shock Test

This test is performed on a sample lot of tubes from each production run to determine the ability of the tube to withstand the specified long-duration impact acceleration. Tubes are held rigid in six different positions in a Medium-Impact Shock Machine and are subjected to three blows in each position. At the end of this test, tubes are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values*.

500 g, Nominal 3/4-Millisecond Shock Test

This test is performed on sample lots of tubes to determine the ability of the tube to withstand the specified impact acceleration. Tubes are held rigid in four different positions in a High-Impact Shock Machine and are subjected to five blows in each position. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values*.

→Indicates a change.

5-to-2000 c/s Variable Frequency and Cycling Vibration Test

This test is performed on sample lots of tubes to determine the ability of the tube to withstand variable frequency vibration. With heater volts = 6.3 ac or dc, dc plate supply volts = 300, dc grid-No.2 volts = 250, grid-No.1 voltage adjusted to give dc plate current of 10 mA., and plate load resistor of 2000 ohms. The tube is vibrated along each of three mutually perpendicular axes over an 8-minute cycle consisting of:

a. 5-to-10 c/s with fixed double amplitude of 0.080 inch ± 10%.
b. 10-to-15 c/s at fixed acceleration of 0.41 g ± 10%.
c. 15-to-75 c/s with fixed double amplitude of 0.036 inch ± 10%.
d. 75-to-2000 c/s at fixed acceleration of 10 g ± 10%.

During the above vibration test, tubes will not show an rms output voltage in excess of 15 volts across the plate load resistor in the 5-to-2000 cycle range. At the end of this test, tubes are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values*.

OPERATING CONSIDERATIONS

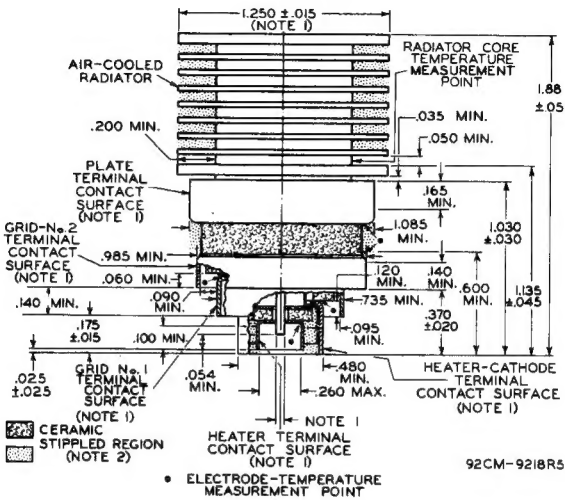
A suggested *mounting arrangement* for the 7457 is shown in the accompanying drawing along with a layout of the associated contacts. Flexible connectors are required for the plate, grid-No.2, grid-No.1, cathode, and heater contact surfaces.

During standby periods in intermittent operation, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes, and that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours. For longer periods, the heater voltage should be turned off.

The rated plate and grid-No.2 voltages of this tube are extremely dangerous to the user. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel can not possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break the primary circuit of the high-voltage supplies when any gate or door on the protective housing is opened, and should prevent the closing of the primary circuit until the door is again locked.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

DIMENSIONAL OUTLINE

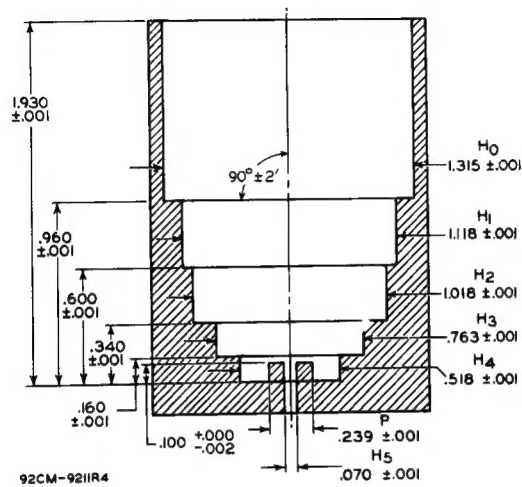


DIMENSIONS IN INCHES

Note 1: With the cylindrical surfaces of the plate terminal, grid-No.2 terminal, grid-No.1 terminal, heater-cathode terminal, and heater terminal clean, smooth, and free of burrs, the tube will enter a gauge as shown in sketch G1. The tube is properly seated in the gauge when a 0.010 inch-thickness gauge 1/8 inch wide will not enter between the heater-cathode terminal and the bottom surface of H4. The gauge is provided with a slot to permit making measurement of seating of heater-cathode terminal on bottom of hole H4.

Note 2: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

SKETCH G_1

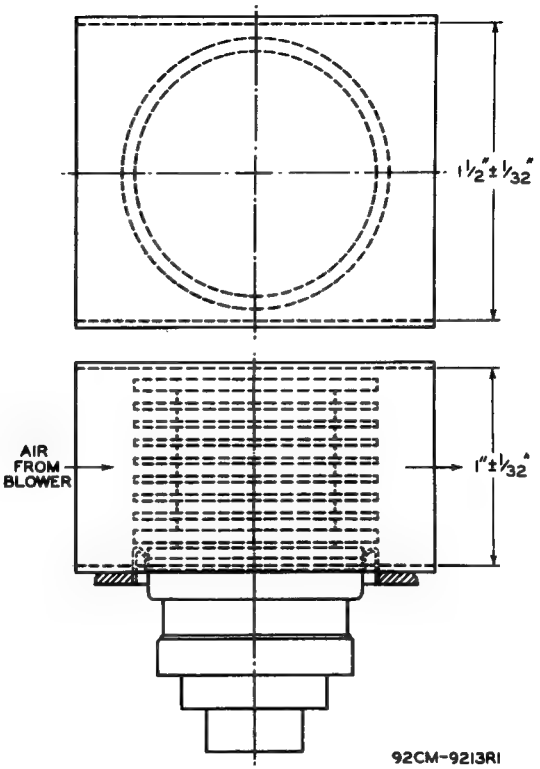


The axes of the cylindrical holes H_0 through H_5 and the axes of post P are coincident within 0.001 inch.

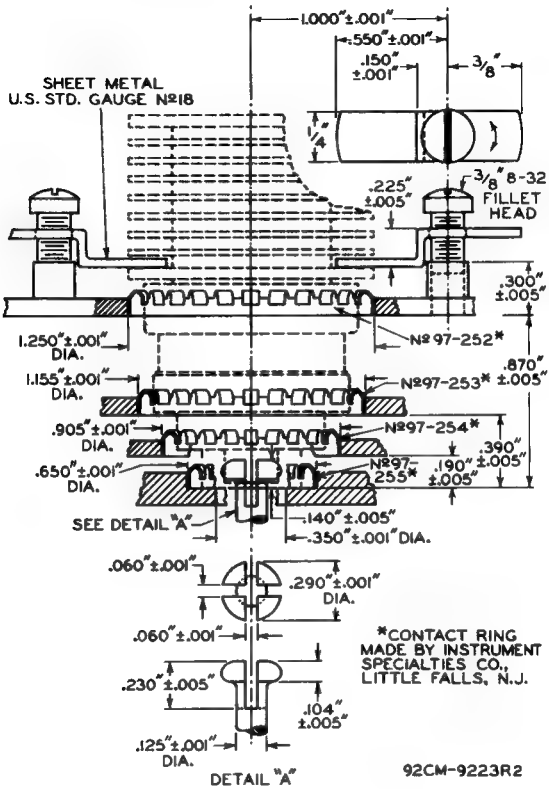
→Indicates a change.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

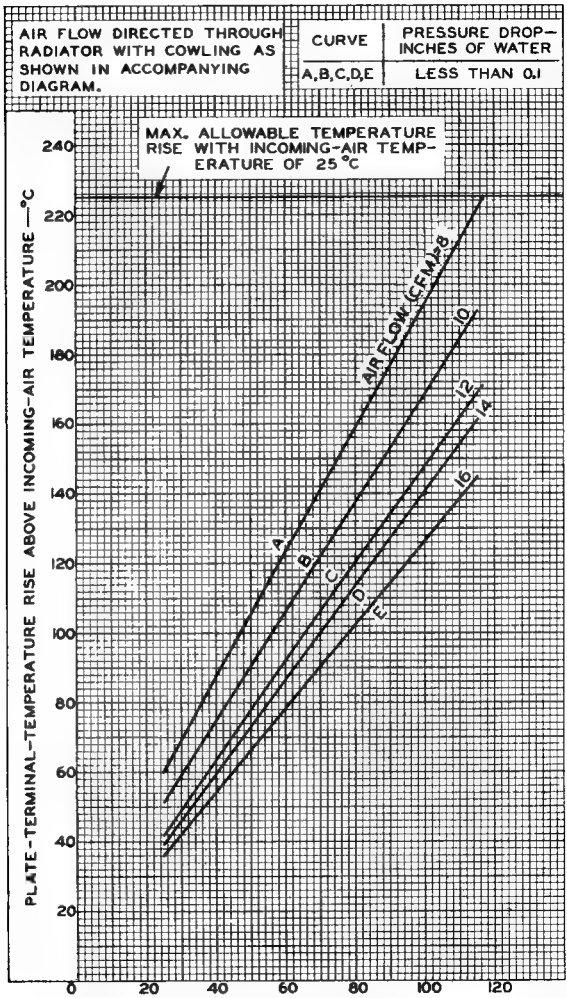
RECOMMENDED COWLING
FOR DIRECTING AIR FLOW THROUGH RADIATOR



SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS

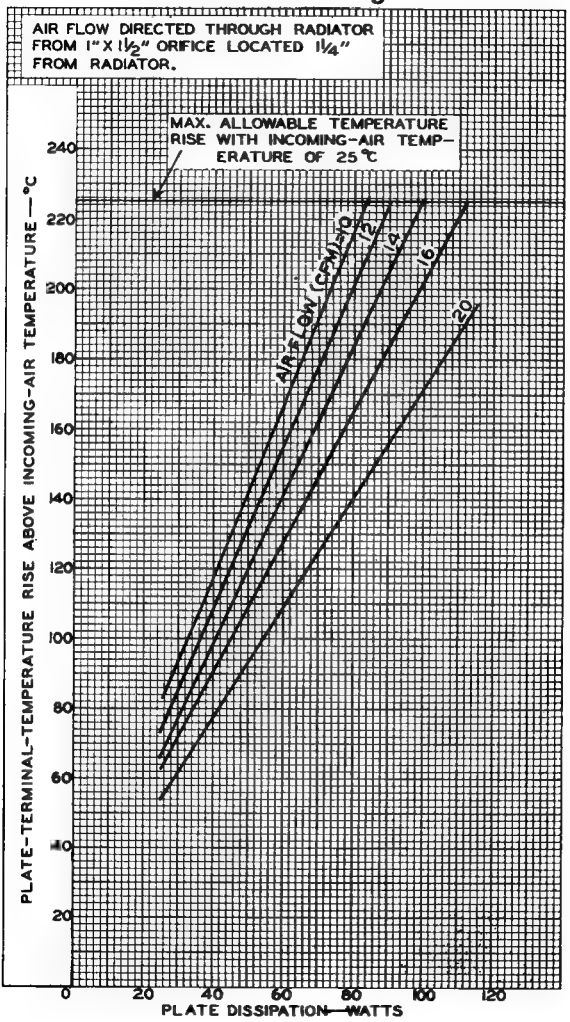


TYPICAL COOLING REQUIREMENTS
With Cowling



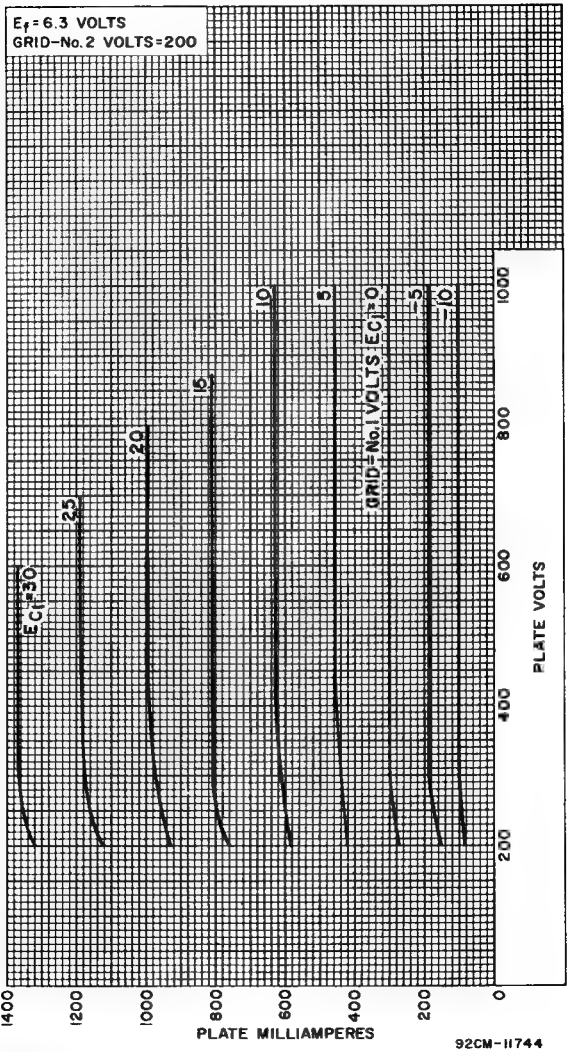
92CM-9219RI

TYPICAL COOLING REQUIREMENTS
Without Cowling



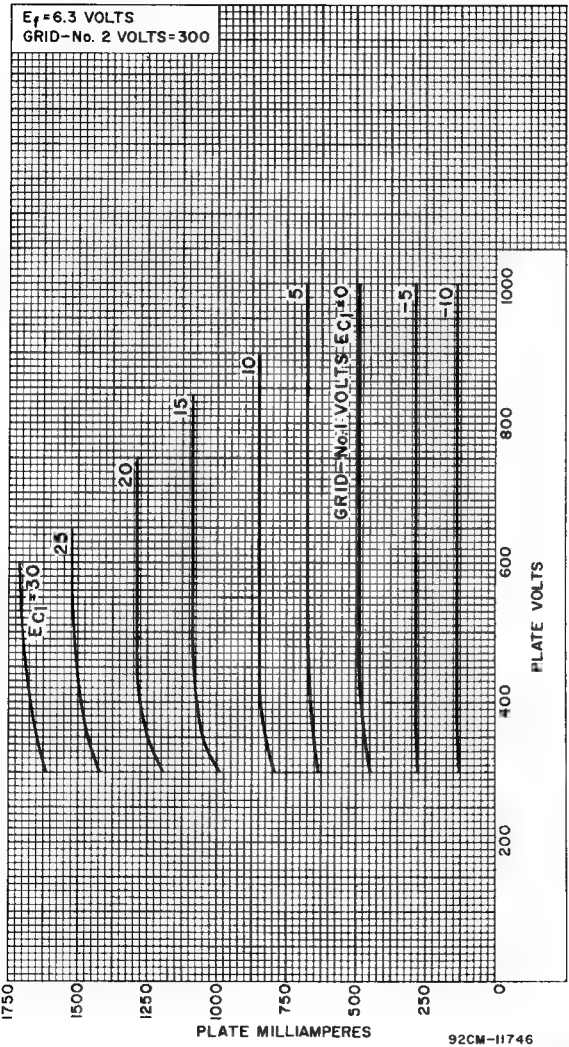
92CM-9220RI

TYPICAL PLATE CHARACTERISTICS

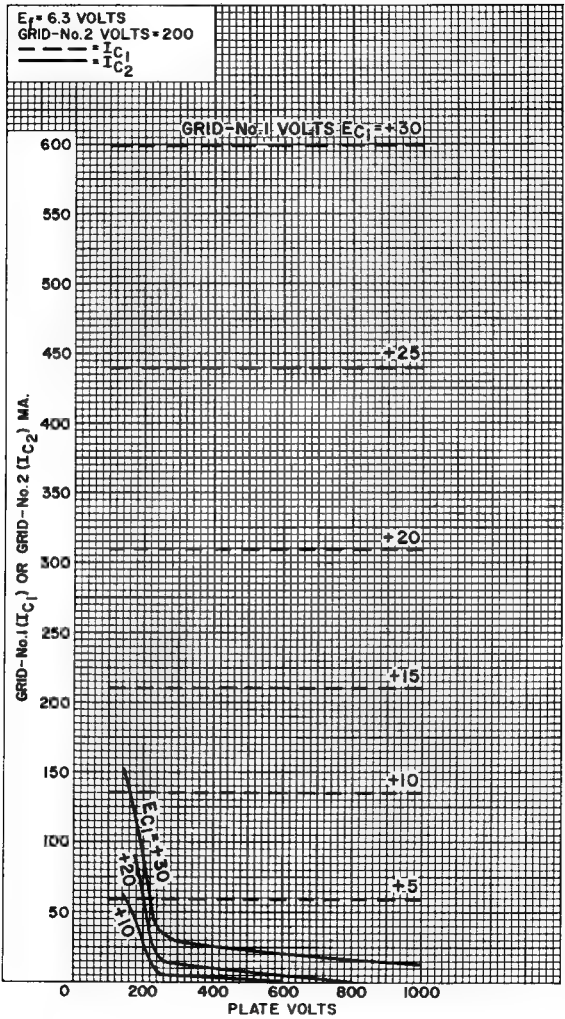


7457

TYPICAL PLATE CHARACTERISTICS

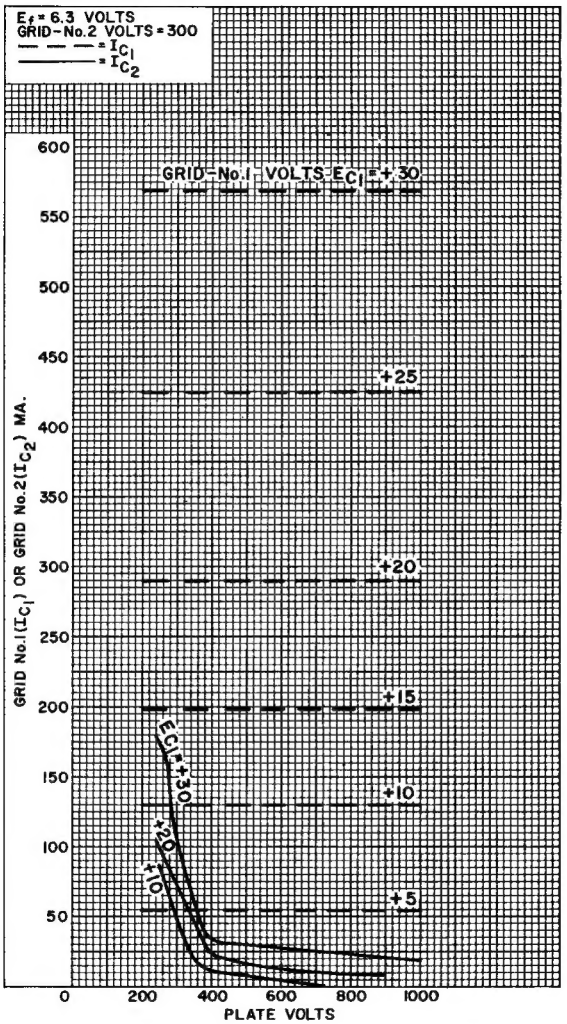


TYPICAL CHARACTERISTICS



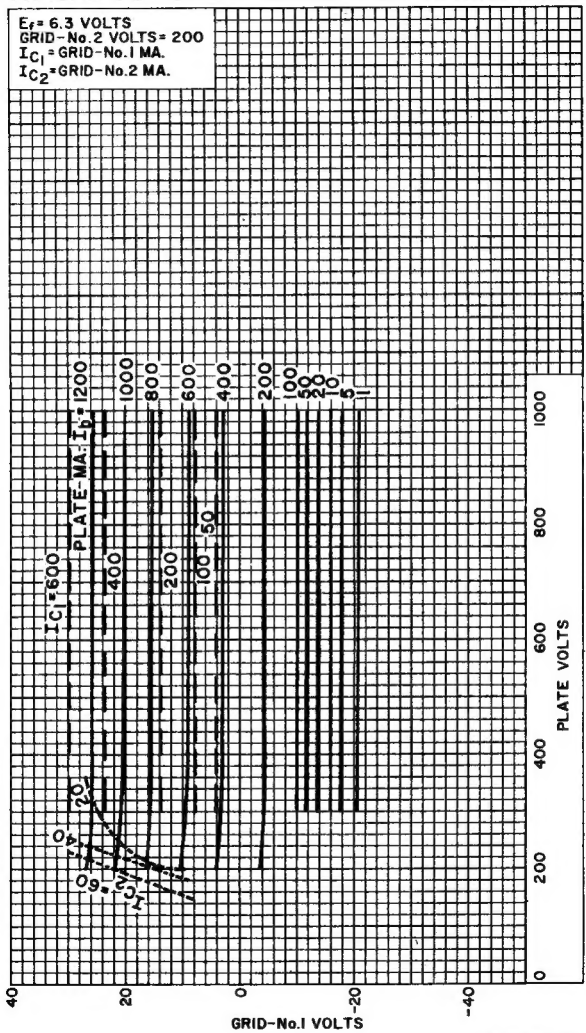
92CM-11747

TYPICAL CHARACTERISTICS



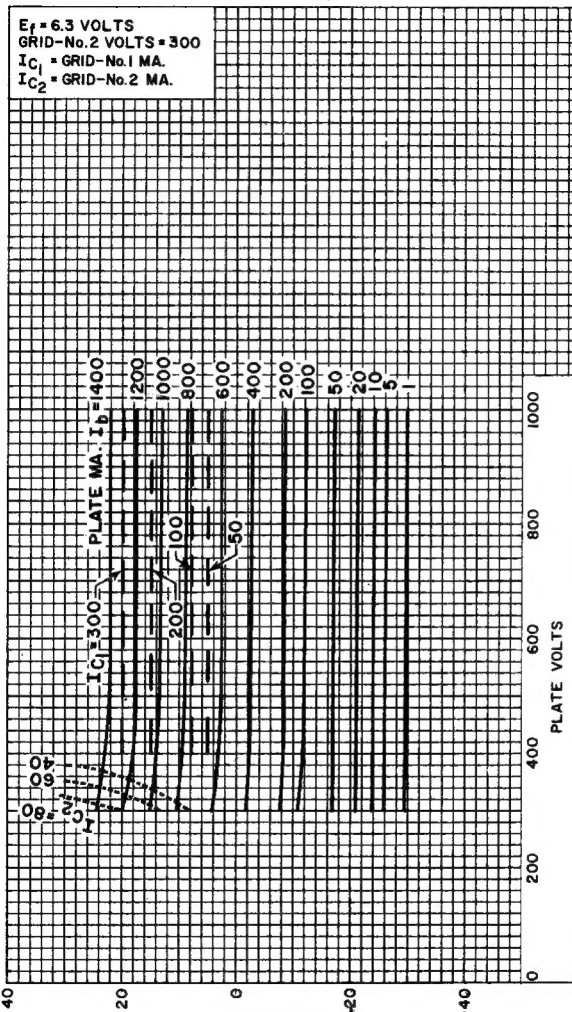
92CM-11748

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-11745

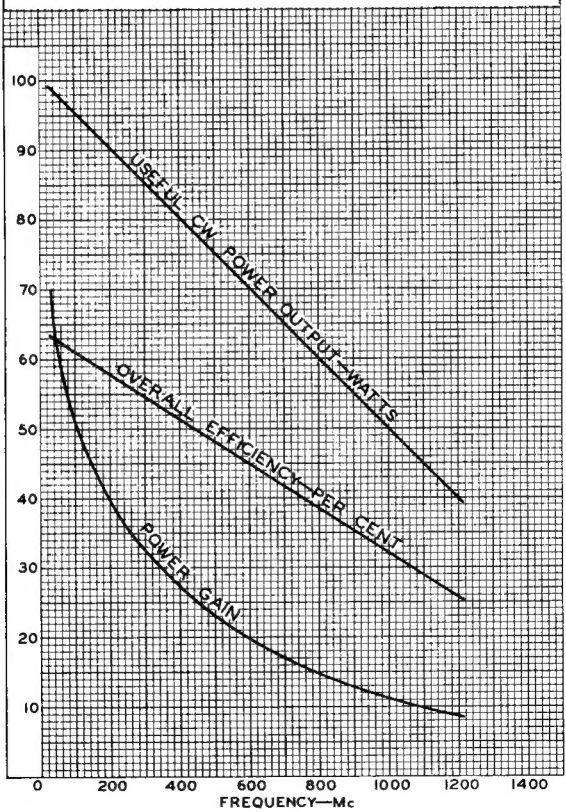
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-11749

TYPICAL PERFORMANCE CHARACTERISTICS
In Class C Telegraphy or Class C FM Telephony Amplifier Service

E_f = ADJUSTED TO SIMULATE NORMAL OPERATING CONDITIONS OF HEATER IN UHF SERVICE
PLATE VOLTS = 900
GRID-N°2 VOLTS = 300
PLATE AMPERES = 0.170
OVERALL EFFICIENCY = USEFUL POWER OUTPUT IN LOAD DIVIDED BY DC PLATE INPUT
POWER GAIN = USEFUL POWER OUTPUT IN LOAD DIVIDED BY DRIVER POWER OUTPUT



92CM-9221